R-300 Wideband Computer Users Guide

(Firmware Version 1.01)

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WARNINGS

Oxygen sensor gets HOT during operation. Do not touch or expose to combustible materials. Serious injury and damage to property may occur.

To prevent fire or shock hazard, do not expose this product to rain or moisture.

Do not operate this product under direct sunlight or in high temperatures. Damage and malfunction may occur.

Unit gets warm during operation. Do not obstruct the ventilation holes on the rear of the unit. This may cause overheat, fire or unit malfunction.

Do not operate this product while driving. This may interfere with driving operations, resulting in an accident.

Do not use this product and its accessories in any way other than specified by PLX Devices. PLX Devices is not liable for accidents or damage cause by misuse of this product.

Do not tamper, disassemble, or modify this product. This may cause an accident, fire, electric shock, or product malfunction.

Do not operate this product without a protective fuse. (5-10 Amps)

INTRODUCTION

Your PLX R-300 is not just a wideband controller, it is a wideband computer! Utilizing the latest computer technologies, your R-300 is equipped with a powerful 32 bit microprocessor giving you the ability to regularly update your operating system with new and exciting features.

KEY FEATURES

1. Measures Wideband Air/Fuel Ratio
2. 6 inputs for data logging (2 Speed, 3 Analog, 1 AFR)
3. 90 minutes of datalogging
4. Fully customizable warning light / shift light
5. High speed USB interface
6. Powerful PC analysis software included
7. Field firmware upgradeable (New features added regularly)
8. Powerful 32 bit integrated processor, RAM, and FLASH technologies

9. 2 analog outputs for 3rd party interface
10. Large dot matrix display with blue backlight
11. 100% backwards compatible with M-Series controllers
12. Compact dash mountable design (4.75 x 2.25 x 1 inch) (120 x 57 x 15 mm)
13. Sensor soft start circuitry, prolongs o2 sensor life

PACKAGE CONTENTS

- R-300 dash mountable compact wideband controller
- Bosch LSU 4.2 Wideband O2 Sensor
- 3ft Bosch O2 Sensor Harness (Controller side)
- 8ft Bosch O2 Sensor Harness (O2 sensor side)
- 3ft Main Harness (controller side)
- 3ft Main Harness (user side)
- 3ft Main Harness Power Wires (user side)
- 6ft USB interface cable (R-300 -> PC connectivity)
- PLX parallel port firmware re-flash card
- Two 0.1uF 50V capacitors
- CD with USB device driver, operating manual in PDF, Latest version of PLX Logger, firmware re-flash utility.

PLX LOGGER SYSTEM REQUIREMENTS

Recommended System Requirements:
Windows 95 or higher operating system
Pentium 4/III/II Celeron 1GHz+
Athlon/Duron 1GHz+
256MB Ram

Minimum System Requirements:
Windows 95 or higher operating system
Pentium 4/III/II Celeron 500MHz
Athlon/Duron 500MHz
128MB Ram

*A 1Ghz+ system will improve real-time data logging performance only. Slower systems may be used if data is downloaded directly from the R-300.

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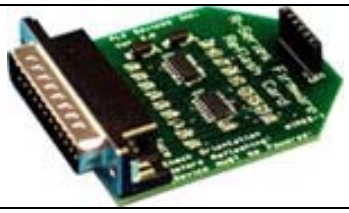
CHAPTER 1

BASICS

1.0 R-300 Unit

1.1 R-300 Cables / Accessories

O2 Sensor Harness/Bosch Sensor	USB Cable	User Harness
Power Harness	**Firmware Re-flash Card**	
		

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1.2 R-300 Cables / Accessories

G Sensor	2 1/16” (52mm) AFR Gauge	AC Adapter (12VDC)

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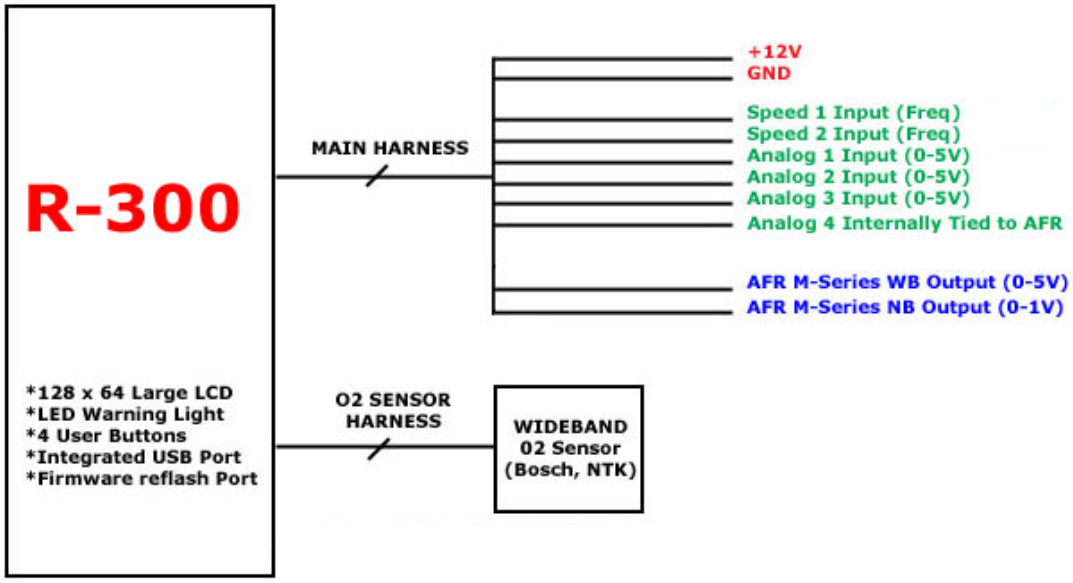
CHAPTER 2

INSTALLATION



R-300 Connection Diagram

Main Harness Wire Colors
+12V – Red (18 gauge)
GND – Black (18 gauge)

Speed 1 – Brown/Black
Speed 2 – Orange
Analog 1 – Red/Black
Analog2 – Orange/Black
Analog3 – Purple
Analog4 – Blue (Unused, analog 4 internally tied to AFR)

AFR M-Series Linear Wideband Output – White
AFR M-Series Narrowband 0-1V - Gray

2.0 Connecting Power and Ground

Connecting your R-300 wideband computer to a reliable power and ground is perhaps the most important procedure to ensuring your unit functions at full potential. Your unit comes included with a 3ft, 18 gauge red and black power cables. Connect the red wire to your vehicle's ignition power (9V-18V). Ignition power is only supplied when your key is turned passed a specific position and power should not be supplied when your key is removed. Connect the black wire to your vehicle's chassis ground.

If you plan to integrate the R-300 with stand alone engine management systems or aftermarket data loggers, make sure that the black wire is connected physically as close as possible to your device's ground to ensure that the same reference ground is seen by both the R-300 and your application. A large voltage offset may be seen if the device is poorly grounded.

Mate the power cable with the R-300 main harness and turn on your ignition power. **Verify that your R-300 wideband computer properly powers up before proceeding with the remainder of the installation.** You should see the PLX Devices splash screen with firmware version number animate on the LCD screen.

2.1 Mounting Your R-300

Your R-300 wideband computer gets warm during operation. Mount your unit in a location where the ventilation holes in the rear are not obstructed and air can easily flow to and from the unit. In the case of in-dash mounts where the area behind the unit is small, it is a good idea to install a small DC brushless fan to circulate air out.

2.2 Installing the Wideband O2 Sensor

Install your wideband oxygen sensor in a Metric 18mm x 1.5mm pitch O2 sensor bung and torque to 45 N*m or 35 ft-lb. Your sensor should be mounted at least 24 inches (609.6mm) downstream from your engine block or turbo for optimal performance. The sensor element will fail if it is exposed to temperatures above 850 degrees Celsius (1,562 degrees Fahrenheit). Mate the provided O2 sensor harness with the wideband sensor and the R-300. If you plan to replace your stock narrowband sensor by utilizing the narrowband output, please read PLXApp004 online for more detailed information.

2.3 Data Logging Inputs

The R-300 is capable of 6 inputs for data logging, 2 speeds, 3 analog, and 1 AFR. The R-300 data logger is NOT vehicle specific and was designed to be compatible with most, but not all, signals to and from your ECU. It is up to the user to determine the viability and compatibility with the intended vehicle to be used based on the descriptions below.

A compatible speed input is defined as an oscillating pulse which switches between a high voltage and a low voltage. A valid high voltage is 2V-25V with respect to ground (black wire) and a valid low voltage is 0-0.8V with respect to ground (black wire). (*Caution: When measuring the voltage of a speed signal, your Voltmeter may not be quick enough to realize that the signal is oscillating, and may take the average of the high and low voltage values of the oscillating signal, so a "15V" signal may damage your signal because the voltmeter is seeing the average of a 30 V peak and a 0 V low.*)

A compatible analog input is defined as a voltage between 0-5V with respect to ground (black wire). Any voltage between 5-25V will be capped to 5V and voltage above 25V will cause damage to the logger.

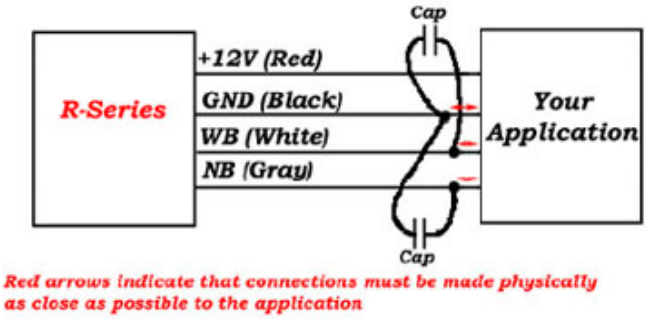
- Speed1 (Brown/Black)
- Speed2 (Orange)
- Analog1 (Red/Black)
- Analog2 (Orange/Black)

- Analog3 (Purple)
- Analog4 (Tied to AFR)

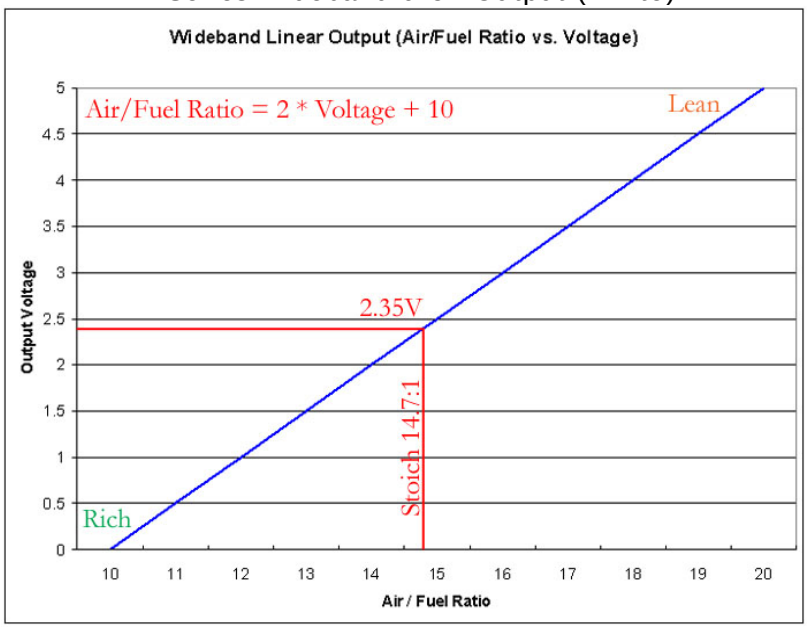
2.4 Output for 3rd Party Interface

The R-300 has 2 analog outputs. These outputs are low impedance and can drive a load up to 20mA.

It is highly recommended that 0.1uF 50V capacitors (included) are installed with every analog output you choose to use. These capacitors filter out unwanted electrical noise from your vehicle and provide you with a reliable analog output to interface to your application. The capacitor should be installed physically as close as possible to your application with one leg connected to the output signal and the other leg connected to your device's ground. If you only choose to use two output signals, 2 capacitors are used (1 for each output). Here is an example.



1. M-Series Wideband 0-5V Output (White)



(Gasoline 14.7)

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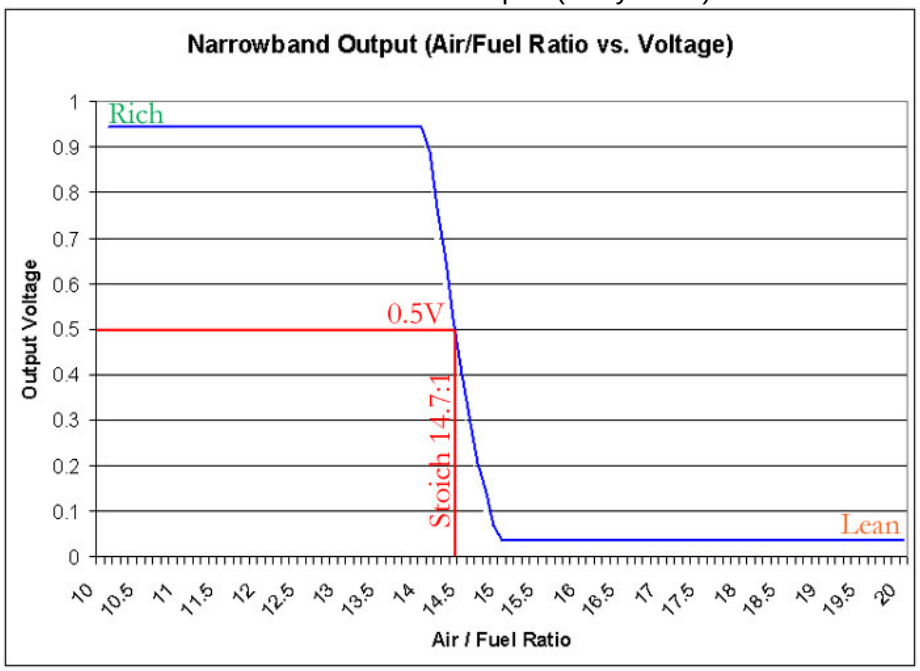
2. Narrowband 0-1V Output (Gray Wire)



(Gasoline 14.7)

The above graphs assume that the device will be used with gasoline (14.7). The M-Series controllers are also compatible with the following fuels.

a. Diesel 14.6
b. Methanol 6.4
c. Ethanol 9.0
d. LPG 15.5
e. CNG 17.2

To find the new relationship of AFR to output voltage, simply multiply the lambda value by the specific fuel's stoichiometric air/fuel ratio.

Example: If your engine uses methanol instead of gasoline. The conversion will be as follows.

1) Divide the AFR value by 14.7 (gasoline) to obtain a lambda value
2) Multiply the lambda value by 6.4 (methanol)

If your engine is running methanol and the M-300/M-200 display readout shows 13.00. Your actual air/fuel ratio is 13.0/14.7*6.4 = 5.66AFR

2.5 USB Port

Proper device drivers must be installed for windows to recognize the R-300 as a valid USB device. Insert the USB cable into the R-300 and your PC's USB port. Specify the location of your device driver when

Windows prompts. The device driver can be found on the CD included with the kit. Windows will recognize this device as “USB Serial Port (Com3-8)” in your Device Manager -> Ports if everything is properly installed. You will only need to install the device driver once.

*Always connect the USB cable 10 seconds before starting PLXLogger. This gives time for Windows to properly detect the R-300 as a valid device. Always close PLXLogger and wait 10 seconds before the USB cable is removed. This allows the software enough time to properly shutdown the PLXLogger USB resources.

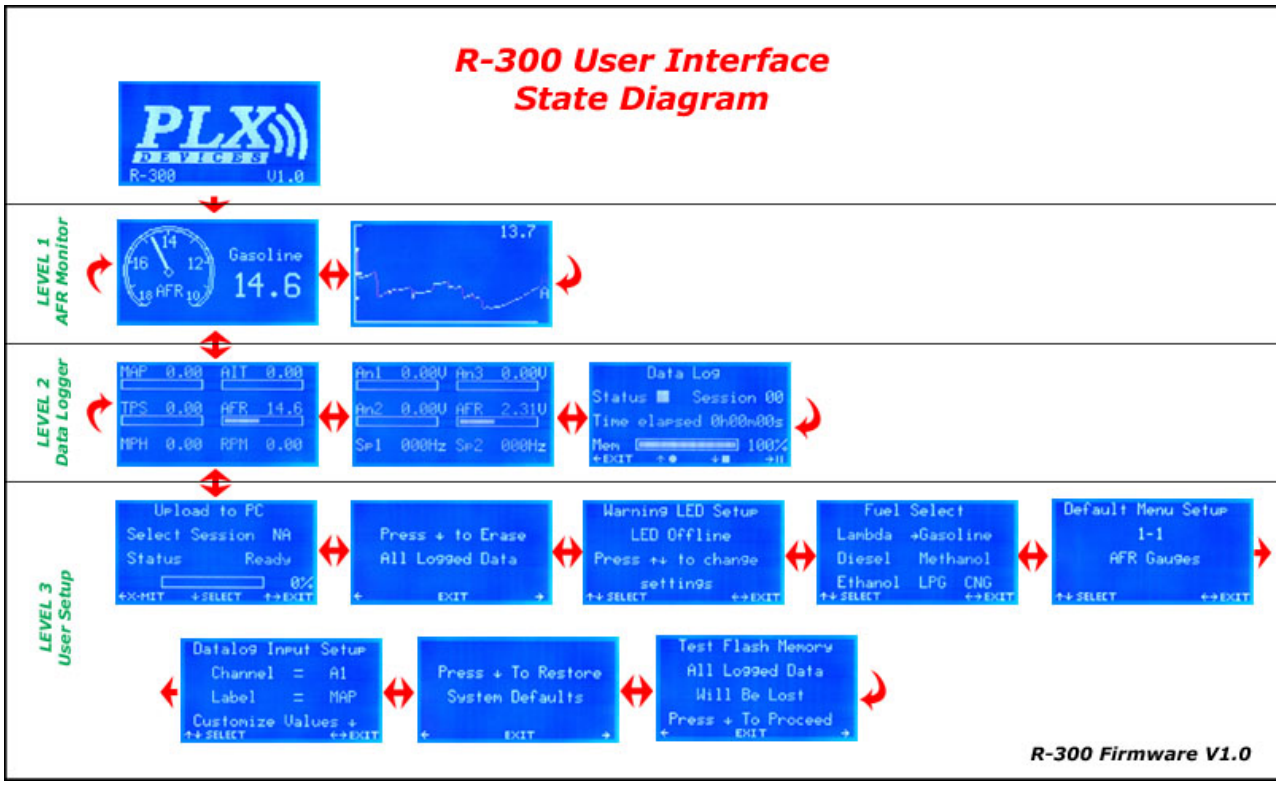
2.6 PLXLogger

Insert the included CD into your computer’s CD Rom drive. Open the PLXLogger folder and run setup.exe. If you have an old version of PLXLogger installed, the installation wizard will automatically uninstall the older version. After completing the installation, start PLXLogger. Set the USB Port# to match the assigned com port number in step (2.5).

CHAPTER 3

USER INTERFACE

3.0 State Diagram



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3.1 Level 1: External Sensors Graphical Display (1-1)

The R-300 defaults to this menu upon unit power up after the PLX logo splash screen if no changes are made to menu (4-5) AFR. The AFR gauge will display a different range depending on the fuel setting selection found in menu (4-4).

The AFR is shown graphically on the gauge on the left side of the screen and also numerically on the right hand corner of the screen.

Pressing the down button on the R-300 brings you to the Level 2 menus.

3.2 Level 1: External Sensors Graph (1-2)

This menu displays a graphical representation of your AFR. This graph draws one pixel at the rate of about 6 Hz (6 pixels a second). The scale for AFR is from .68 to 1.36 lambda (10-20 AFR in gasoline settings). The AFR line has an “A” letter next to it. The graph may be cleared by pushing the up button on the R-300.

Pressing the down button on the R-300 brings you to the Level 2 menus.

3.3 Level 2: Data logger Input Signal Monitor (2-1)

There are two settings to the data logger input signal monitor menu:

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1. In its default state this menu graphically and numerically displays the voltage measurements from the analog data logger inputs and also the numeric values from the speed inputs (in Hz).

The voltage representation bars correspond to the analog signal directly above them. If the bar is empty the voltage =0 V, if the bar is full the voltage = 5 V

You may use this menu to verify that you have the data logger inputs properly set-up. To toggle to the user configured data push the **left button** on the R-300.

2. The secondary state of this menu displays the customized labels for all the data logger inputs (3 characters) and also converts the signals into data that is easily readable. The labels and conversion values for each signal can be configured in menu (4-6). To toggle to the raw data logger input data push the **left button** on the R-300.

The R-300 will prompt you to save the settings of this state (raw or customized data) upon exit if you have changed between the two settings.

Pressing the down button on the R-300 brings you to the Level 3 menus.

3.4 Level 2: Data logger Recorder (2-2)

This menu is used to control the data logger's recording functions. Pushing the left button exits this menu to return to menu (2-1). **Pressing the up button will start the recording of the signals displayed in menu (2-1) into the internal flash memory.** Pressing the right button will pause/resume the data recording without creating a new data log session. Pressing the down button will stop/terminate the data logging session. Starting the data logger after pushing the stop button will create a new session.

The shape to the right of the "Status" text displays a square if the data logger is not recording, a Circle if the data logger is recording, and two parallel lines if the data log session is paused.

The number to the right of the "Session" text displays the current data logger session that is being recorded to. The maximum number of sessions that can be recorded is 99.

The string of numbers next to the "Time elapsed" text states the length of the current data log session in hours, minutes, and seconds.

The graphical bar and percentage number to the right of the "Mem" text displays a graphical and numerical representation of the amount of memory left in the R-300s internal memory bank. The bar will

empty and the percentage number will decrement as memory is depleted. The R-300 is capable of recording up to 90 minutes of data. Be aware that you are limited to 99 recording sessions regardless of the amount of memory you have left.

3.5 Level 3: PC Upload (3-1)

This menu is used to select a data log session to upload to the PC. Here are the procedures of how upload sessions to the PC:

Before uploading to the PC, verify that your PLXLogger gauges display in real-time the correct information. For example, if you have speed 1 connected to your RPM signal; make sure that the PLXLogger software displays the correct RPM on your gauge.

Be aware: If you do not configure your gauges on the PLX Logger on the PC, your R-300 will then send raw voltages and frequencies to the PC that may be difficult to decipher. The R-300 will stream data continuously through the USB port in any state other than the PC Upload Menu (4-1 this menu).

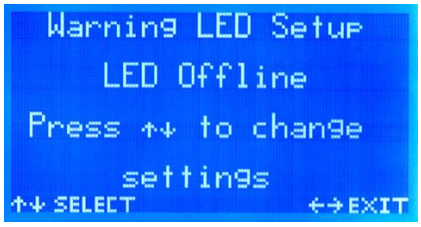
1. Push the down button to toggle through all the saved data logger sessions resident in the R-300s memory.
2. Start the PLXLogger software on the PC.
3. On the toolbar for the PLX Digital Dash, select File → R-Series Flash Download and click it. A blue window should pop up prompting you to upload the data logged state. **Do not upload session until this window is opened! Failure to do so will result in data corruption!**
4. Press the left button on the R-300 to transmit the session to the PC.
5. Upon successful transmission, PLXLogger Software will prompt you to enter the file name of the data logger session that was just uploaded. The file can now be analyzed using the 2D and 3D logger on the PLXLogger software.

3.6 Level 3: Clear Data logged Sessions (3-2)

This menu is used to delete all data logged sessions stored in the R-300's internal memory. Push the down button to delete all logged sessions. You will be prompted to confirm your decision.

Press the right button then to confirm your intent to permanently delete all your logged data. Press the left button to cancel the erasing process.

3.7 Level 3: Warning LED Setup (3-3)



This menu configures the Red Warning LED found on the top of the R-300. The second line of text displays the current function of the warning LED. If no parameters are set, it will display "LED Offline". If one parameter is set for the warning LED, it will display "1 variable". If two parameters are set, it will display "2 variables".

From the default entry position of this menu press the up or down button to gain access to the two warning LED trigger parameters. Once you have chosen the variable that needs to be modified, use the Left/Right button to navigate the cursor to the proper location of the parameter/number that needs to be adjusted. To change the parameter directly over the cursor push the Up/Down button toggle the value.

The warning LED will illuminate if the statements of all active variables are "true".

Here are two examples of how to use the warning light.

1. To configure the warning LED to trigger when the AFR is greater than 14.7 AFR and when throttle position is greater than 50%:
   Hook up the throttle position signal wire to one of the analog signal inputs on the data

logger. In this example the throttle position voltage is 0.15V for 0%, 0.5V for 50%, .85 V for 100% throttle, and the throttle position signal from the ECU is connected to A2. To set this up, the variable 1 parameter would be set to "AFR > 14.7" and variable 2 would be set to "A2 > 0.50 V".

2. To use the warning LED as a shift light:
Hook up the tachometer signal to one of the speed inputs on the data logger. In this example, the tachometer signal is attached to S1 (speed 1) and the redline/shift point is at 200 Hz. To set this up, the variable 1 parameter would be set to "S1 > 0200 Hz". This setup would turn on the warning LED if the pulse signal from the tachometer signal exceeds the entered value in the selected variable.
*FYI: To find the proper frequency for the shift point, rev the engine of the car to the desired RPM and look to see the speed signal that the R-300 is receiving. Knowing the conversion modifier for Hz→RPM may also be helpful in deriving this number.

You will be prompted to save your settings upon leaving this menu if you have changed any of the values.

3.8 Level 3: Fuel Selection (3-4)

This menu is used to set the fuel type being used by the vehicle. Press the up/down button to select the correct fuel type. Press the right/left button to exit this menu. The settings in this state affect the gauge in menu (1-1) and also the numeric readout in menu (1-2). For your reference, here are the stoic values for each type of fuel: Lambda 1.0, Gasoline 14.7, Diesel 14.6, Methanol 6.4, Ethanol 9.0, LPG 15.5, and CNG 17.2. You will be prompted to save your settings upon leaving this menu if you have changed any of the values.

3.9 Level 3: Default Menu Selection Menu (3-5)

This menu is used to select the menu that the R-300 defaults to upon boot-up (power-on). Press the up/down button to move the selection arrow down next to the 2nd line with numbers. After doing so,

press the left/right button to select the menu that you wish to be vectored (directed) to upon boot-up. These are the possible selections for starting menus:

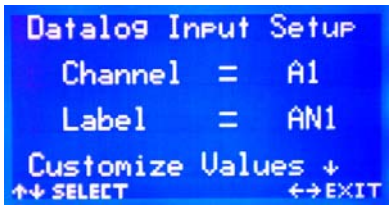
1-1 AFR Gauges (Default)

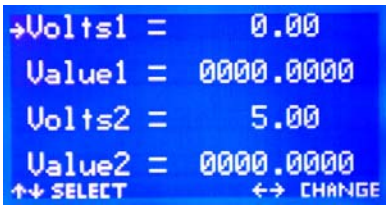
1-2 AFR Graph Numeric

2-1 Datalogger Monitor

2-2 Data logger Recorder

3.10 Level 3: Data logger Input Setup (3-6)





This menu allows you to convert the voltage and pulses coming in from the data logger harness into values that are easily readable and understandable by the end user. Making changes in this state will affect the labels and data on the secondary setting of the Data log Inputs Menu (Menu 2-1).

Press the up/down button to move the pointer arrow to the parameter that needs to be adjusted. Pressing the left/right button next to the "Channel" text toggles through the R-300's analog and speed channels (A1-A3, S1, S2). Pressing the left/right button next to the "Label" button moves a cursor under the 3 character label that you can customize. The valid characters that you can choose from are: capital A-Z, 0-9, ←, →, and a blank space.

Pressing the down button while the pointer arrow is pointing to "Label" will bring you into the submenu which allows you to configure the relationship between voltage (or frequency) and value by entering to voltage (or frequencies) and two corresponding values.

Press the up/down button to move the cursor to the parameter to be modified, then press the right/left button to move the cursor under the numeric value to be modified. To modify a number push the up/down button while the cursor is under the number.

Be advised that the "values" entries only have 6 digits of precision. If the event that you run into any floating point glitches you may solve this problem by maxing out the value number to either -9999 or 9999 (repeatedly increment or decrement the thousands unit. Once you max it out, this will effectively clear the decimal point values) and then re-entering the value that you wish to input.

Attempting to leave this submenu will bring you to the linear relationship display and prompt you to save your changes. You will be prompted to save your settings upon leaving this menu if you have changed any of values.

Here's an example on how to customize your signals:

1. Let us just say that you want to have RPM shown on S1 (where tach signal is attached)

   Set the Channel to S1 and change the label to: “RPM”

Let’s just say your tach signal pulses at 20 Hz at 600 RPM, and 150 Hz at 4500 RPM. Enter these values:

/*-------------------------*/

Freq.1 = 0020

Value1 = 0600.000

Freq.2 = 0150

Value2 = 4500.00

/*-------------------------*/

Using the up/down buttons to leave this configuration menu will direct you to the linear relationship display and show the following:

/*-------------------------*/

Linear Relationship

Value = mV + b

m= 30.00

b= 0000.0000

/*-------------------------*/

Thus, (30*frequency)+0= RPM

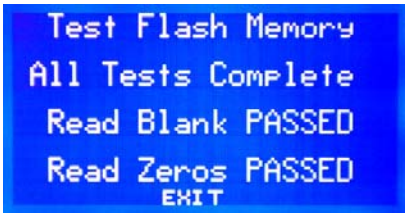
Press any button to exit. Be sure to save your settings (right button).

3.11 Level 3: Restore Defaults Menu (3-7)

This menu is used to restore all user settings to the system defaults. Press the down button to restore system defaults.

3.12 Level 3: Flash Memory Test Menu (3-8)

This menu is used to test the integrity of the flash memory in the R-300. Upon pressing the down button the R-300 proceeds to test the erase, read, and write functions in each data cell of the R-300. The results of the test are then posted for review. Press the left/right button to exit this menu. Be advised: all logged data will be permanently deleted from flash memory when this test is executed! Test takes 6 minutes to complete. Do not power the unit down during this operation.



R-300 Technical Specifications

Overview	
Operating Voltage	9V – 18V
Power Consumption	25 Watt Max, 15 Watt Typical
Power Supply Technology	High Efficiency Switching
Operating Temperature	0 – 70 Degrees Celsius (0-158 Degrees Fahrenheit)
Physical Dimensions	4.75 x 2.25 x 1 inch (120.65 x 57.15 x 15.4 mm)
CPU	Custom PLX 32 Bit Microprocessor
Clock	32 MHz
USB Interface	High Speed USB 2.0
Display	128 x 64 Pixel Blue Backlit LCD
Warning Light	High Intensity Red LED
Analog Outputs	Linear AFR, Narrowband AFR
Firmware Upgradeable	Yes

External Sensors	
O2 Sensors	Bosch LSU4.2, (NTK L1H1, L2H2 versions available)
Useful Lambda Range	0.68 Lambda - 1.36 Lambda
Wideband O2 Technology	Digital PID (Fast response)
Wideband O2 Accuracy	< 0.1AFR (Gasoline)
O2 Sensor Soft Start	Yes (Prolongs O2 Sensor Life)

Data Logger	
Inputs	2 Speed, 4 Analog *(1 dedicated for AFR)
Speed Input Range	4Hz - 10KHz
Analog Input Range	0-5V (25V Max Voltage Protection)
Flash Memory	~80 Minutes
Sampling Rate	10 Samples/Sec (10 Hz)

TERMS OF USE

PLX Devices Inc. does not guarantee the M-200/M-250/M-300's functionality with any ECU, data logger or other devices that uses the output signals. Implementation and integration of the M-200/M-250/M-300 with any other device(s) must be done at your own risk. Improper installation and usage may lead to engine damage. Mount and install the M-200/M-250/M-300 in a location where it does not obstruct the driver's view and/or ability or safely control the vehicle.

LIMITED WARRANTY

PLX Devices Inc. warrants this product to be free from defects for 90 days from the date of purchase. If applicable, Oxygen sensors and other non-serviceable items are excluded from stated warranty. Serviceable goods must be determined by PLX Devices to be defective before any warranty or replacement is issued. PLX Devices' obligation under warranty shall be limited to repairing or replacing, under the discretion of PLX Devices, any part proven defective. This warranty is limited to the repair or replacement of parts in the manufactured good and the necessary labor done to affect its repair or replacement.

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SERVICE UNDER WARRANTY

In the unlikely event that your PLX Devices hardware should fail during the warranty period, a Return Material Authorization number (RMA) must be first retrieved from PLX Devices Customer Support. Support can be contacted through email: support@plxdevices.com or by phone: 408-745-7591. All serviceable goods must be packaged securely with proof of purchase, RMA number, with all shipping charges prepaid and shipped to PLX Devices Inc. Goods returned under warranty must be received by PLX Devices Inc. within ten (10) business days after the RMA number has been issued. Goods received after this period is subject to fees for the service of repair or replacement. All repaired or replaced items shall be warranted for the remainder of the original product warranty.

RETURNS AND RESTOCKING FEE

A 15% restocking fee will apply to applicable PLX Devices products for refund. All returns are to be packed in original condition including packaging, documentation, manuals, and accessories. Returns that do not include all the accessories and components may be returned to the customer or charged on a per item basis. The customer assumes responsibility for product until receipt at PLX Devices Inc., shipping via an insurable carrier is recommended. Any unauthorized shipping charges will be billed to the customer or shipment will be refused.

DISCLAIMER

PLX Devices Inc. shall not be liable for direct, special, incidental, or consequential damages resulting from any legal theory including, but not limited to, lost profits, downtime, goodwill, damage, injury to persons, or replacement of equipment and property due to improper installation, integration and/or misuse of any PLX Devices Inc.'s product(s). This warranty applies to the original purchaser of product and is non-transferable. All implied warranties shall be limited in duration to the said 90 day warranty period.

Revision History

Version 1.0 (10/6/05)	Initial release
Version 1.1 (2/9/06)	Added detailed information for Warranty and returns Added information regarding firmware version 1.01